Department of Commerce
National Telecommunications and Information Administration
Implementation of the National Spectrum Strategy
Notice of Opportunity for Public Input

COMMENTS OF AURA NETWORK SYSTEMS, INC.

AURA Network Systems, Inc. (AURA) appreciates the opportunity to respond to the National Telecommunications and Information Administration's (NTIA) above-referenced request for input regarding the implementation of the National Spectrum Strategy (NSS).[1] AURA commends the NTIA, the Administration, and the Federal Communications Commission (FCC) for collaborating on the creation of the NSS, which will help ensure the continued development and success of myriad new services that depend on spectrum. The NSS, along with the Presidential Memorandum on Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy,[2] sets the foundation for the evolution of spectrum policy, including continuing to improve the necessary interagency process. Importantly, the NSS recognized the need for spectrum to support the next generation of aviation, including remotely piloted and autonomous aircraft.[3] This recognition aligns with broader government efforts focused on the acceleration of technologies and services within Advanced Air Mobility (AAM).[4]

AURA is designing and building a secure, reliable data and voice command and control (C2) communications network that will enable crewed and uncrewed aircraft to safely navigate through national airspace, including beyond visual line of sight (BVLOS), using licensed aviation-designated spectrum. AURA's purpose-built, full stack solution for C2 uses the existing

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[1] Department of Commerce, National Telecommunications and Information Administration, Implementation of the National Spectrum Strategy, Notice of Opportunity for Public Input, 88 Fed. Reg. 85266 (Dec. 7, 2023); *The National Spectrum Strategy*, The White House (Nov. 13, 2023) (NSS).

[2] *Memorandum on Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy*, Joseph R. Biden Jr., President, United States of America (Nov. 13, 2023), https://www.whitehouse.gov/briefing-room/presidential-actions/2023/11/13/memorandum-on-modernizing-united-states-spectrum-policy-and-establishing-a-national-spectrum-strategy/.

[3] NSS at 3 ("These spectrum bands are a mix of Federal and shared Federal/non-Federal bands—with an emphasis on mid-band frequencies—that will be studied for a variety of uses, including terrestrial wireless broadband, innovative space services, and unmanned aviation and other autonomous vehicle operations.").

[4] *See*, *e.g.*, Department of Transportation, Request for Information on Advanced Air Mobility, Notice and Request for Information, 88 Fed. Reg. 31593 (May 17, 2023).

licensed spectrum in the 450 MHz band to which AURA holds the exclusive rights. Its solution includes airborne radios, a nationwide ground network, and a spectrum management and frequency assignment system that AURA is building from the ground up to support Uncrewed Aircraft Systems (UAS) operating BVLOS in controlled airspace.[5]

Within this context, AURA is pleased to offer its thoughts on the optimal approach to implement the NSS (Implementation Plan). As detailed below, AURA suggests that the Implementation Plan a) continue to set a national priority for spectrum for next generation aviation; b) reflect an Administration position that the 5030-5091 MHz band should be reserved exclusively for aviation purposes; and c) encourage the FCC to i) move forward with some rules for the 5030-5091 MHz band, ii) continue to encourage the industry to help resolve other parts of the rules, and iii) only undertake well-considered and defined interference analyses for the band. More broadly, AURA suggests that NTIA establish a spectrum policy framework that leverages industry-government groups to conduct detailed sharing studies when appropriate that are focused on engineering outcomes, create new research and development programs, and help foster new engineering talent.

I. The NSS Established the National Priority for Spectrum to Support the Next Generation of Aviation.

The NTIA correctly notes that a key component of the NSS is a spectrum pipeline to "make spectrum available for new uses and meet growing demand" for spectrum, including to support the next generation of aviation services.[6] The recognition of these spectrum needs is a crucial acknowledgement of the advanced communication, navigation, and surveillance required for the safe integration of emerging technologies like AAM and UAS.[7] AAM and UAS operations will transform global transportation. Analysts estimate AAM will grow to a market value of $115 billion annually by 2035, with 280,000 high-paying jobs.[8] Governments across the

[5] *See* https://www.auranetworksystems.com.

[6] NSS at 3.

[7] For a detailed analysis of the spectrum needs of AAM, AURA created a detailed white paper, which it filed with the Department of Transportation in response to its request for comment on the creation of a national AAM strategy. AURA Network Systems, *Enabling Communications for Advanced Air Mobility: Technologies, Services, and Policies* (Aug. 2023), https://auranetworksystems.com/white-papers.

[8] Deloitte and AIA, Advanced Air Mobility: Can the United States Afford to Lose the Race? (2021).

world are racing for first-mover advantages in policy and regulatory frameworks to capture AAM's significant economic, societal, environmental, and safety benefits.

Control and non-payload communications (CNPC) support the safety-critical data exchanges between the aircraft and the pilot on the ground, including C2. UAS and AAM operations demand real-time decision-making and execution. UAS flying in controlled airspace and AAM operations require robust, reliable, and secure C2 connectivity between pilots and aircraft to ensure flight safety; without C2, uncrewed and remotely piloted flights in operating in the National Airspace System (NAS) and UAS BVLOS operations are not possible. This connectivity relies on dedicated spectrum, new radio technologies, new ground networks, and new communications services. Without spectrum access, C2 service suppliers cannot provide this required functionality to UAS and AAM operators, and those operators cannot complete their operational approval processes.

The NSS identified the 5030-5091 MHz band as currently under consideration by the FCC to meet future demand for new spectrum-based services and technologies.[9] The FCC's pending proceeding for this band involves a complicated set of stakeholders, but with clarity, the Implementation Plan can chart a path forward over the near and medium term that provides the industry a roadmap to final rules that will, in turn, provide certainty and predictability for continued and future investment. Dedicating the 5030-5091 MHz band exclusively for CNPC enhances the safety, security, and efficiency of UAS operations, allowing for robust communications, monitoring an aircraft's status, executing precise commands, and ensuring the overall success of operations.

To build upon momentum in the industry, however, it is also important to consider additional spectrum bands to support UAS and AAM operations. AURA currently holds general aviation air-ground licenses providing an exclusive nationwide footprint in the 450 MHz band under the existing Air-Ground Radiotelephone Automated Service. These licenses allow it to provide C2 and voice services to aircraft, including UA, consistent with a waiver granted to AURA by the FCC.[10] Operators should have the option to utilize the frequency that best suits their needs, including through modernized rules for this band.

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[9] NSS at 4-5.

[10] *See generally AURA Network Systems OpCo, LLC and A2G Communications, LLC Request for Waiver*, Order, 36 FCC Rcd 262 (WTB 2021). AURA also has a rulemaking request pending with the FCC seeking permanent rule

II. The Implementation Plan and any Near-term Rules Should Encourage the Creation of the Core Framework for Licensed Access to the 5030-5091 MHz Band, Limit the Band's Use to CNPC, Resolve Issues on the Record on Which There is Broad Consensus, and Provide a Roadmap for Resolution of Outstanding Issues.

A. The Implementation Plan and Any Near-term Rules Should Make Clear That the 5030-5091 MHz band Should be Used Only for CNPC.

In its Notice of Proposed Rulemaking regarding use of the 5030-5091 MHz band for the operation of UAS (C Band NPRM or NPRM), the FCC proposed to limit the band to CNPC communications.[11] The FCC correctly noted that CNPC systems require an extremely high degree of reliability, especially if used for safety-of-life communications, and – at least currently – do not have other terrestrial spectrum to fall back to if interference occurs.[12] AURA strongly agrees with the FCC's proposal.

Spectrum used for safety-of-life services often are afforded a higher degree of protection from interference via specific allocation. Indeed, as AURA noted in its comments to the FCC in response to the NPRM, the Commission has already allocated the 5030-5091 MHz band for AM(R)S, which the International Telecommunication Union and the FCC define as "reserved for communications relating to the safety and regularity of flight, primarily along national or international civil air routes."[13] For purposes of the 5030-5091 MHz band, the FCC proposes defining CNPC transmissions as "any UAS transmission[s] that [are] sent to or from the UA component of the UAS and that support[] the safety or regularity of the UA's flight."[14] UAS CNPC would therefore clearly qualify as AM(R)S communications.

The U.S. UAS industry is in the early part of its expected growth curve that will drive significant economic activity through the creation of new technologies and services. Dedicated

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changes to allow the 450 MHz band to be used for the provision of C2 and voice services to crewed and uncrewed aircraft. *See* Petition for Rulemaking of A2G Communications, LLC, and AURA Network Systems OpCo, LLC, WT Docket No. 20-185 (filed Feb. 16, 2021).

[11] *Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems, WT Docket No. 22-323, Petition of AIA for Rulemaking to Adopt Service Rules for Unmanned Aircraft Systems Command and Control in the 5030-5091 MHz Band*, RM-11798 (terminated), Notice of Proposed Rulemaking, FCC 22-101 (rel. Jan. 4, 2023) at ¶ 47. (NPRM).

[12] *See id.* at ¶ 4.

[13] Comments of AURA Network Systems, Inc. at 7-8, and citations therein (AURA Comments). Unless otherwise specified, all comments referred to herein were filed in the FCC's WT Docket No. 22-32 on March 9, 2023.

[14] NPRM, App. A, 47 C.F.R. § 88.5 (proposing definition of CNPC); *see also id.* at ¶ 47 (discussing the proposed definition of CNPC).

spectrum will be necessary to enable this growth – particularly for BVLOS operations. Numerous parties that commented in the FCC's NPRM proceeding agree that the 5030-5091 MHz band should be used solely for UAS CNPC. Spectrum Resources, Inc., for example, noted that "limit[ing] this band to [CNPC] … will ensure that [it] is maintained for the critical functions of unmanned flight."[15] Lockheed Martin Corporation noted that "licensing the 5030-5091 MHz band specifically for UAS CNPC will have important public benefits."[16]

Further, there is no countervailing policy prerogative to permitting other uses in the band. Spectrum policy drives towards maximizing the allocation and assignment of spectrum in the public interest. Given that C2 is fundamental to next generation aviation and that this is the only new band identified to support this industry, it is clear that the public interest is maximally served through the use of this band for C2. Other uses for the band, even on a secondary basis – specifically mobile wireless – should be rejected.

Given the 5030-5091 MHz band current allocation and the critical importance of high reliability for UAS CNPC, the NTIA's NSS Implementation Plan should support the FCC's proposal to limit the band to CNPC communications.

B. The Implementation Plan and any Near-term Rules Should Recommend a Clear Licensing Structure Based on the Licensing Model Rather Than the Use Case.

In the C Band NPRM, the FCC proposed to apportion different band segments for what it calls Network-Supported Service (NSS) and Non-Networked Access (NNA).[17] Although these two use cases will both exist in the provision of service to UAS, AURA argued that there is no need for the FCC to specify the network implementation or architecture utilized by a licensee. Rather, the key distinction should simply be how the spectrum is licensed – *i.e.*, on an exclusive use or shared use basis.[18]

To support CNPC, UAS operators may require a relatively small network (*e.g.*, two base station sites), a very large network (*e.g.*, a nationwide network of base stations), or a point-to-point link (*i.e.*, one base station). This may vary between operators and within single operators depending on the concept of operations. There is no technical reason, however, that both NSS

[15] Comments of Aviation Spectrum Resources, Inc. at ii.

[16] Comments of Lockheed Martin Corporation at 4.

[17] NPRM at ¶¶ 14-17.

[18] *See* AURA Comments at 10-11.

and NNA services cannot be provided in the same band segment – the network architecture should not dictate the licensing scheme.

It may be the case, for example, that an operator in a very remote area needs a CNPC service that has multiple sites, but with no competition for the spectrum the CNPC provider would have no need to participate in an auction for a wide-area exclusive use license. Similarly, a large scale CNPC provider with exclusive use licenses covering large geographic areas may choose to offer a point-to-point service to certain customers or certain use cases. Rather than place limits on the licensee's ability to choose its preferred architecture, the FCC should allow the licensee maximum flexibility within the confines of either the exclusive use or shared spectrum rules. What is most important is that the FCC create licensing structures that support very large-scale deployments with protected spectrum necessary to provide guaranteed access to frequencies to flights in controlled airspace, and lower-barrier access to spectrum for uses that can tolerate lower levels of access to spectrum.

The Implementation Plan should encourage a licensing structure in the 5030-5091 MHz band that is based on the licensing model rather than the use case to maximize the licensee's flexibility in offering services to best meet customer demand.

C. The Implementation Plan Should Encourage the Resolution of Other Issues, Including the Creation of a Rule Part and Reliance on RTCA.

In the NPRM, the FCC proposed to adopt a new rule part – Part 88 – for the use of the 5030-5091 MHz band for UAS CNPC.[19] Because UAS requires a new type of regulatory framework that pulls from different aspects of various spectrum policy and management approaches, the Implementation Plan should support the FCC's proposal.

As AURA noted, the FCC would be well within its precedent in creating a new rule part to govern a new type of service such as UAS. The Commission, for example, created Part 96 for the Citizens Broadband Radio Service (CBRS) rules that combined elements of licensed and unlicensed service, similar to what is being proposed in the 5030-5091 MHz band.[20] In creating the CBRS rule part, the FCC noted that such a result "promote[d] administrative efficiency." Creating a new rule part that would house rules for UAS CNPC would similarly promote

[19] *See* NPRM at Appendix A (proposing the addition of Part 88 (Unmanned Aircraft Control Services)).

[20] *See* AURA Comments at 6.

administrative efficiency. Indeed, should the FCC later authorize additional spectrum for UAS CNPC, it could simply include that spectrum in the proposed new Part 88, along with other spectrum bands that support a similar type of service, including the 450 MHz band.

The Implementation Plan should also cement the RTCA's role in setting the standards for the band – which should significantly inform the technical rules and the band plan – and in facilitating or participating in the multi-stakeholder process necessary to establish the standards, protocols, and process for frequency coordination using a dynamic frequency access system. In the NPRM, the FCC acknowledged that the Federal Aviation Administration (FAA) has "the jurisdictional responsibility to ensure the safety of aircraft, including UAS, and is tasked by statute with the safe integration of UAS into the National Airspace System."[21] RTCA, one of the standards development organizations that the FAA relies on for industry consensus technical and operational standards development, has recently released DO-377B, which provides a methodology for UAS manufacturers to design their C2 link systems to be compliant with FAA regulations for approval to safely operate in U.S. airspace. DO-377B, DO-362A (Standard for C2 Link Systems operating in the 5030-5091 MHz Band), and other standards developed by RTCA for UAS operation, should be relied on by the FCC as it establishes a new rule part governing UAS.

D. The Implementation Plan Should Help Drive the Resolution of the Band Plan.

The NPRM's record offers a diversity of viewpoints regarding the band plan for the 5030-5091 MHz band.[22] If the Implementation Plan supports, and FCC clarifies, that the band should be used only for CNPC, that will remove many of the blockers to finalizing the optimal band plan – including the division of spectrum between exclusively licensed and shared licensed portions – as well as interference protections, channel sizes, and other band plan and licensing rules.

As AURA has stated, significant industry technical analysis of potential UAS use cases – and the spectral and technical requirements for each – should inform the 5030-5091 MHz band

[21] NPRM at ¶ 3.

[22] *See, e.g.,* AURA Comments at 6-8 (suggesting the 5030-5091 MHz band be licensed on both exclusive use and shared us bases, without distinction between network architectures); Edison Electric Institute Comments at 18 (recommending licensed blocks of either 2.5 MHz or 5 MHz, with NNA opportunistic access); Qualcomm Comments at 15 (suggesting a dedicated 20 MHz channel for both DAA and CNPC); Verizon Comments at 5 (suggesting contiguous NNA and NSS blocks).

plan.[23] The Implementation Plan should encourage the industry to come to a consensus on the band plan in the near term, and the Commission should propose a more detailed band plan in a Further Notice of Proposed Rulemaking (FNPRM) that can help drive and build a record of support for the right band plan.

E. While There is no Need for Further Interference Analysis, to the Extent the Implementation Plan Considers it, the Implementation Plan Should be Precise About What Needs to be Studied, Why, and the Costs/Benefits of Protecting Other Bands Relative to This Critical Use Case.

The NSS mentions the longer-term analysis of interference in the 5030-5091 MHz band but offers no details on what bands or systems need to be protected, how the interference analysis would take place, or any other information.[24] Much of this analysis, however, has already been completed and the resulting standards should be incorporated in any new rule part.

In the NPRM, the FCC identified other allocated uses of the band (either directly or through footnotes), including radio astronomy, AeroMACs, radionavigation-satellite service, and flight testing.[25] RTCA has been working on standards for both airborne and ground radios operating in the 5030-5091 MHz band since 2012. This includes publishing and revising a standard titled "Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial)" RTCA DO-362A. Development of that standard included extensive analysis of potential interference between users of the band and the protection of out of band users above and below the 5030-5091 MHz band.

In-band coexistence assessments are captured in DO-362A "APPENDIX R – UNDESIRED-TO-DESIRED SIGNAL AND SIGNAL-TO-NOISE PLUS INTERFERENCE RATIOS." The appendix includes a detailed analysis and description of the mechanisms by which one or more undesired (interfering) signals degrade the performance (availability) of the CNPC link system. This analysis is used to show how calculated U/D ratios and SNIR may be used to determine GRS separation criteria for assigning adjacent and non-adjacent channels to CNPC Link Systems.

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[23] *See* AURA Comments at 9.

[24] *See* NSS at 6.

[25] *See* NPRM at ¶¶ 100-109.

Adjacent band compatibility is addressed in DO-362A "APPENDIX T – PROTECTING ADJACENT BAND SYSTEMS AGAINST INTERFERENCE FROM TERRESTRIAL C BAND CNPC LINKS." This appendix contains a detailed analysis of how equipment built to the DO-362A standard will be compatible with the RTCA AeroMACS standard[26] that governs the design of transceivers that operate in the 5000-5030 MHz and the 5091-5150 MHz bands. Given the existence of RTCA DO-362A, no further analysis is necessary to protect AeroMACS. To the extent the Implementation Plan calls for additional interference analysis for other allocated uses, it should articulate precisely what needs to be studied and why. It should further articulate the costs/benefits of protecting operations in other bands relative to the critical use case of UAS CNPC and follow precedent to the extent applicable to establish the levels of protections for adjacent bands or other services that may require protection.

III. More Broadly, NTIA Should Formally Establish the Detailed Basis Under Which Sharing Analysis Will Take Place, the Objective Criteria it will Consider, and the Leadership Tasked with Providing Direction and Making Clear Decisions.

Spectrum policy is a complex optimization problem with quantitative and qualitative inputs. Historically, spectrum policy reflects a unique dichotomy between purely policy-based decisions grounded in public policy outcomes, commercial outcomes, and federal mission outcomes, and the accompanying technical analysis justifying technical rules, band plans, and sharing requirements. This process is, and likely always will be, flawed. Policy arguments are subjective, and generally optimized for a particular outcome reflecting the preference of a group, company, or agency. Technical analysis, while more objective, may fall victim to subjectivity regarding system requirements and performance, future technology variability, and the policy objectives of a given group.

It is infeasible for regulators to make perfectly informed decisions regarding the right allocation of spectrum, the assignment of it, and the rules governing it. There are, however, strategies that policymakers and regulators can adopt to make sure their decisions regarding spectrum allocation and assignment are as objective as possible. The first strategy is to work towards a shared organizing goal. The NSS and accompanying Presidential Memo accomplish

[26] RTCA DO-346A AeroMACS MOPS.

this – they layout pillars and processes that set the paradigm for the preferred outcome and methods for these critical decisions.

The second strategy is to leverage industry-government stakeholder groups that are made up of broad and diverse representatives with policy leadership and a predominance of technical expertise. Multistakeholder groups can help stimulate new ideas and by nature dilute any single party's ability to unilaterally drive the result to a preferred outcome. There are important elements of an effective multistakeholder group, including:

1. Authority & Leadership– the people involved need to have the authority to offer their input and as necessary make decisions, and the leadership to drive towards reasonable conclusions/recommendations/results.
2. Breadth & Diversity – the group needs to reflect a broad swath of interested parties with differing policy viewpoints and technical capabilities. A group dominated by one or a few large players will not drive an optimized output.
3. Purpose – the group needs to have a specific task, with alignment around completing that task at the outset, with a deadline.
4. Transparency & Trust – if the participants do not trust each other or the process, the output will be flawed.
5. Bias to Engineering – the group should focus on technical analysis over policy debates.
6. Equitable Power – a group that is led by one interest group – even as broad as "government" or "industry" is by nature going to produce less optimized results. Government and industry have made progress in this regard and can continue to; the evolution from the EMBERS process to the PATHSS process – from government only to government and industry – is a great start.

The third strategy is to create mechanisms to support the research and development necessary to study the technical solutions to these problems, and relatedly, the ecosystem of people who can help solve them. There are two parts to this: funding, and education.
On funding, NTIA could establish – either itself or through the National Science Foundation – annual recurring Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs focused specifically on wireless research and development. SBIR and STTR programs are successful across government, with the most value-creating focused on

specific agency needs. Wireless technologies do appear in some agency proposals, but a directed, specific focus on wireless to solve critical spectrum policy and sharing needs will help stimulate new technologies that may not otherwise be funded.

With respect to education, the SBIR / STTR program is a helpful start because it will create an incentive for new engineering talent to focus on wireless issues. In addition, the government should work directly with research institutions and industries to grow the base of people who have expertise in wireless, which will both facilitate new ideas and ensure a continued pipeline of capable engineers.

IV. Conclusion

AURA applauds the NTIA for its leadership in prioritizing spectrum for UAS, recognizing the pivotal role it plays in securing U.S. success in advanced aviation. The Implementation Plan should lay the groundwork for a collaborative, flexible, and efficient approach, to ensure success of the NSS and foster safety and growth for UAS and AAM operations. Specifically, the importance of dedicating the 5030-5091 MHz band exclusively for CNPC, while considering additional spectrum such as AURA's 450 MHz band, will provide operators the flexibility to choose the band that best suits their needs. AURA praises the collaborative efforts of the NTIA, the Administration, and the FCC and appreciates the opportunity to contribute to the NSS Implementation Plan. AURA looks forward to working with the NTIA in the future.

Respectfully submitted,

AURA Network Systems, Inc.

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